# "Expandable unit, in particular for houses or offices"

## FIELD OF THE INVENTION

The subject of the present invention is an expandable unit, in particular for houses or offices.

## BACKGROUND OF THE INVENTION

The present invention relates to an expandable unit which is intended particularly for use as a house or office in emergency and/or temporary situations, for example, in the event of natural disasters, for public events of limited duration, or the like.

More particularly, the invention relates to an expandable unit which is produced in the form of a container so that it can be transported easily to the place of use and can quickly be rendered operative on site.

Units in the form of containers suitable for the purpose specified above are known. An example is described in GB 2051172 which provides for the structure of a known container to be modified in order to convert it into a portion of a building in which to store the goods transported by the container.

For this purpose, GB 2051172 shows a container

provided with means which enable at least one wall of the container to be turned outwards by being pivoted about pins, hinges or similar devices carried by a wall adjacent the openable wall.

Although the above-described solution enables the original dimensions of the container to be increased, it seems quite complex and has functional limitations since it requires the use of further external elements to produce a complete building. Moreover, the ratio between the initial area of the container and the final area of the building is not very good.

A further example is provided in US 4,653,659, which describes a transportable structural element having the standardized shape and dimensions of a container. In particular, the container comprises a frame and at least one wall articulated to the frame so as to be pivotable between a closed position in which it defines a wall of the container and an open position in which it can be fixed to an adjacent container to form an enlarged building structure.

This solution thus also provides for the enlargement of the initial dimensions of the container to be achieved by virtue of the presence

of a wall articulated on one side. As a result, although the original size of the container is increased, the solution described in US 4,653,659 also fails to offer a very good ratio between the initial and final dimensions, as well as requiring the presence of further panels to complete the structure.

It is clear from the foregoing that there is a need to provide an expandable unit, preferably a container of standardized shape and dimensions, which has a simple structure that is easy to extend, achieving a very good ratio between the initial area of the container and the final area of the building.

The problem underlying the present invention is therefore that of proposing an expandable unit, in particular for homes or offices, which has structural and functional characteristics such as to satisfy the above-mentioned need and, at the same time, to overcome the disadvantages mentioned with reference to the prior art.

SUMMARY OF THE INVENTION

This problem is solved by means of an expandable unit, in particular for houses or offices, produced in the form of a container, wherein it comprises a

basic module provided with at least a roof supported by uprights and at least one extractable module operatively associated with the basic module so as to translate relative thereto, the extractable module comprising a base and a roof which are parallel to the roof of the basic module and side walls which connect the base and the roof so as to form a parallelepiped, open on one side corresponding to the side that is inside the basic module.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and the advantages of the expandable unit according to the invention will become clear from the following description of preferred embodiments given by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a perspective view of an expandable unit in the contracted configuration,

Figure 2 shows the expandable unit of Figure 1 in a further configuration,

Figure 3 is a plan view of the expandable unit of Figure 2,

Figure 4 is a perspective view of an expandable unit in an expanded configuration,

Figure 5 is a plan view of an expandable unit in the expanded configuration,

Figure 6 is a perspective view of an expandable unit in an expanded configuration,

Figure 7 is a perspective view of a detail of an expandable unit according to one of the preceding drawings,

Figure 8 shows the detail of Figure 7 in a different operative condition,

Figure 9 shows, in section, the detail of Figure 7 of the expandable unit according to the present invention,

Figure 10 is a perspective view of a detail of an expandable unit according to one of the preceding drawings,

Figure 11 is a front view of the detail of Figure 10,

Figure 12 shows, in section, a detail of an expandable unit according to one of the preceding drawings.

Figure 13 shows the detail of Figure 12 in a different operative condition,

Figure 14 shows, in vertical section, the expandable unit in the contracted configuration,

Figure 15 shows, in horizontal section, the

expandable unit in the contracted configuration,

Figure 16 shows, in vertical section, the expandable unit in the expanded configuration,

Figure 17 shows, in horizontal section, the expandable unit in the expanded configuration,

Figure 18 is a plan view of an example of modular use of the expandable unit according to the present invention,

Figure 19 is a perspective view of the example of Figure 18,

Figure 20 is a plan view of a further example of modular use of the expandable unit according to the present invention,

Figure 21 is a further perspective view of the example of Figure 20.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the above-mentioned drawings, an expandable unit, in particular for houses or offices, is generally indicated 10. The unit is preferably produced in the form of a container, possibly retaining standardized shape and dimensions, at least when the unit is in a contracted configuration, as shown, for example, in Figure 1.

With reference, for example, to Figure 1, the

expandable unit 10 comprises a frame 12 formed by a series of members 14 arranged horizontally to form a base and a top and a series of members 16 arranged vertically to form uprights interconnecting the base and the top.

In order to define an absolute reference system, "horizontal" is intended to define a plane parallel to the surface supporting the container, and "vertical" is intended to define a plane perpendicular to the horizontal plane.

The expandable unit 10 also comprises a basic module 18 which, according to one embodiment, comprises a roof 20 and two side walls 22 mounted on the frame 12 in a fixed manner, on opposite sides of the roof. The roof 20 and the side walls 22 of the basic module constitute corresponding walls of the expandable unit 10, both in the contracted configuration and in the expanded configuration.

In the embodiment of Figure 1, the side walls 22 define the short sides of the expandable unit although, in further embodiments, a different arrangement may be provided.

The expandable unit 10 may also have a base, not visible in Figure 1, mounted on the frame 12,

parallel to the roof 20.

In other words, the basic module 18 may be produced in the form of a parallelepipedal container open on two facing sides, that is, lacking two opposed side walls, for example, those which define the long sides of the expandable unit 10 of Figure 1, although a different arrangement may be provided.

The expandable unit 10 also comprises at least one extractable module 24 operatively associated with the basic module so as to translate relative thereto.

In the embodiments shown, two extractable modules are preferably provided, disposed on opposite sides of the expandable unit 10, although a different arrangement may be provided, for example, a single extractable module for each unit 10.

With reference, for example, to Figure 4, which shows an expandable unit in the expanded configuration, it can be seen that each extractable module 24 comprises a side wall 26 which also defines a side wall of the expandable unit 10, both in the contracted configuration and in the expanded configuration.

The extractable module 24 also comprises a base 28, for example, shown in Figure 14, which is arranged

parallel to the base of the basic module, if it has one, and a roof 29, which is arranged parallel to the roof 20 of the basic module 18. Further side walls of the extractable module 24, indicated 30, are arranged as closures between the base 28, the roof 29 and the side walls 26 of the extractable module.

In other words, at least when the expandable unit 10 is in the expanded configuration, the extractable module adopts the shape of a parallelepiped or container which is open on one side, that is, that lacks one side wall.

As shown in the drawings, the extractable module 24 may have at least one frame 32 which surrounds the module, for example, in the region of the side wall 26. This frame extends beyond the outside dimensions of the extractable module 24 so as almost to reach the overall dimensions of the basic module 18.

The basic module 18 and the extractable module 24 are operatively associated with one another in a manner such that the extractable module translates relative to the basic module, for example, by means of guides 34 interposed between the two modules.

In the embodiment shown in Figure 4, the guides 34

are shown in the upper portion of the expandable unit and support the extractable module 24. These guides may also advantageously be provided in the lower portion of the expandable unit 10, for example, they may be fitted between the base of the basic module and the base of the extractable module.

Figures 7 and 8 show an embodiment of the guides 34 shown in two different operative conditions. In greater detail, Figure 7 shows a guide in the contracted configuration corresponding to the contracted configuration of the expandable unit 10, as shown, for example, in Figure 2. Similarly, Figure 8 shows a guide in the extended configuration, corresponding to the expanded configuration of the expandable unit 10, as shown, for example in Figure 6.

As shown in Figures 7-9, each guide 34 comprises a tubular element 36 associated with the extractable module 24. According to one possible embodiment, an end of the tubular element 36 is fixed firmly to the frame 32 of the extractable module 24. Each guide 34 also comprises a seat 38 formed, for example, by a hollow tubular element fixed firmly to the roof 20 of the basic module 18, inside the

basic module.

As is clear from Figure 9, the tubular element 36 preferably has a shape defining at least four regions of contact with elements of the seat 38. An example of this shape comprises inclined planes 39a and 39b, for example, arranged parallel to one another in pairs. The inclined planes indicated 39a preferably have opposite inclinations and constitute upper regions of contact with elements of the seat 28. Similarly, the inclined planes indicated 39b also preferably have opposite inclinations and constitute lower regions of contact with elements of the seat 38.

Each tubular element 36 slides inside one of the seats 38 with the interposition of rolling elements 39c housed in the seat 38 to permit translation of the extractable module relative to the basic module during the transition of the expandable unit between the contracted configuration and the expanded configuration and vice versa.

According to one possible embodiment, for example, shown in the appended drawings, the extractable module 24 comprises two portions which are slidable relative to one another in order further to increase the volume of the expandable unit 10 in

the expanded configuration.

An outer portion of the extractable module 24, indicated 24a, comprises the roof 29, the base 28, and the side walls 30 of the extractable module 24, as described above.

The guides 34 described above are disposed between the roof 29 of the outer portion 24a and the roof 20 of the basic module 18. Further similar guides may be provided between the base 28 of the outer unit 24a and the base of the basic module 18.

An inner portion of the extractable module 24, comprising the side wall 26, is indicated 24b. The inner portion 24b also comprises a base 40 and a roof 42 arranged parallel to the roof 29 and to the base 28 of the outer portion 24a. In addition to the foregoing, the inner portion 24b comprises side walls 44 which connect the roof 42, the base 40, and the side wall 26.

Further guides 46, interposed between the side walls 30 of the outer portion 24a and the side walls 44 of the inner portion 24b, permit relative translation of the two portions.

These further guides 46 are shown in detail in Figures 10 and 11. This latter Figure 11 corresponds to the configuration in which the

guides 46 are mounted between the outer portion 24 and the inner portion 24b.

The further guides 46 comprise wheels 48 coupled with a cross-member 50. The wheels 48 are mounted rotatably on the outer face of the side wall 44 of the inner portion 24b, and the cross-member 50 is fixed to the inner face of the side wall 30 of the outer portion 24a.

According to one possible embodiment, each wheel 48 has a peripheral recess 52 which interacts with a "V"-shaped edge of the cross-member 50.

The guides 46 associated with one side of the extractable module preferably have the above-mentioned recess 52, whereas the guides 46 associated with the other side of the extractable module do not have the above-mentioned recess 52, in order to take any play.

According to one embodiment, the roof 20 of the basic module 18 comprises an abutment element 54 disposed on the side which houses the extractable module 24 and extending inwardly relative to the expandable unit 10.

Similarly, the roof 29 of the outer portion 24a comprises an abutment element 56 disposed on the inner edge of the expandable unit 10 and extending

outwardly relative to the expandable unit. This abutment element 56 can interact with the abutment element 54 of the basic module 18 when the expandable unit is in the expanded position (Figure 16).

On the opposite side, that is, on the outer side of the roof 29, there is a further abutment element 58 which extends inwardly relative to the expandable unit 10.

Similarly, the roof 42 of the inner portion 24b comprises an abutment element 60 disposed on the inner edge of the expandable unit 10 and extending outwardly relative to the expandable unit. This abutment element 60 can interact with the abutment element 58 of the outer portion 24a when the expandable unit is in the expanded position (Figure 16).

Similar abutments are present on the side walls and on the base of the basic module 18, of the outer portion 24a, and of the inner portion 24b (Figures 15 and 17).

According to one possible embodiment, the abutment elements, in particular those between the basic module 18 and the outer portion 24a, are formed as shown in Figures 12 and 13.

The abutment element 54 of the basic module 18 comprises an appendage which extends inwardly relative to the unit. This appendage comprises a plate 54a, one end of which is fixed to the appendage, and a contact portion 54b.

The abutment element 56 of the outer portion 24a comprises an appendage which extends outwardly relative to the unit for a distance such as to interact with the appendage of the abutment element 54. An end of the appendage of the abutment element 56 comprises a contact portion 56a which can interact with the plate 54a of the abutment element 54 and a sealing element 56b which can fit closely against the contact portion 54b of the abutment element 54.

In the expanded configuration of the expandable unit 10, the abutment elements 54 and 56 are in contact with one another as shown in Figure 13. In particular, the contact between the plate 54a and the contact portion 56a forms an electrical contact which ensures impermeability to electromagnetic waves (EMI protection) should the expandable unit be used to house radiophonic and electronic apparatus. Moreover, the contact between the sealing element 56b and the contact portion 54

ensures watertightness.

To achieve a very good ratio between the initial area, that is, in the contracted configuration, and the final area, that is, in the expanded configuration, whilst avoiding the presence of steps, the base 40 of the extractable module 24 and, in particular, of the inner portion 24b, comprises at least a first portion 40a and a second portion 40b, connected to one another by connection means which permit relative folding thereof, for example, by pins or hinge connections.

Figure 14 shows an expandable unit 10 in the contracted configuration in which it is clear that the first and second portions 40a and 40b of the base of the extractable module 24 are arranged at 90°. Figure 16 shows the expandable unit of Figure 14 in the expanded configuration in which the first and second portions 40a and 40b of the base of the extractable module 24 are arranged at 180°, constituting extensions of one another to define a floor without steps.

The drawings show an embodiment in which the expandable unit 10 comprises a basic module 18 and two extractable modules 24 fitted in two facing sides of the expandable unit.

Each of the two extractable modules comprises a base 40 with at least a first portion 40a and a second portion 40b, connected to one another by connection means which permit relative folding thereof, for example, pins or hinge connections.

Moreover, each of the two roofs 29 comprises an abutment element 56 for interacting with a corresponding abutment element 54 of the basic module 18.

In particular, Figure 14 shows a section through the expandable unit 10 shown in the contracted configuration, in which the arrangement of the bases and of the roofs of the two extractable modules 24 is clear.

The respective second portions 40b of the two bases are in contact with one another and substantially perpendicular to the respective first portions 40a. Moreover the roofs of the two extractable modules are at a lower level than the roof of the basic module, so that they can be superimposed when the expandable unit 10 is in the contracted configuration.

In addition to the foregoing, a possible embodiment of the expandable unit 10 may have means 62 for bearing on the ground, mounted on the frame 12,

preferably at its corners or on the uprights 16.

The means 62 comprise, for each corner of the expandable unit 10, an electromechanical cylinder arranged with its axis vertical. The cylinder is mounted on the frame 12 by means of articulated arms 64 so as to be pivotable between a retracted position in which it is housed in a recess 66 formed in the walls of the expandable unit 10 and an extended position in which the cylinder projects from the body of the expandable unit 10.

A support foot 68 is associated with the piston of the electromechanical cylinder and, when the cylinder is in the extended position, is urged against the ground in order to lift and level the expandable unit 10.

Each cylinder is controlled independently of the others in order to compensate for any unevenness of the ground.

The method of use of the expandable unit as described above is as follows.

In its contracted configuration (Figures 1, 2), the expandable unit 10 occupies a small space, preferably comparable to that of a container for transporting goods. This compact configuration permits easy transportation even of a large number

of expandable units and easy positioning of the unit in the place of use.

The means 62 are pivoted in order to be moved to the extended position and each electromechanical cylinder is operated in order to urge the support feet 68 against the ground.

As soon as the expandable unit is correctly positioned on the ground, each extractable module is translated relative to the basic module until the maximum travel of the guides is reached. This translation immediately makes an enlarged space available, without the need for further elements to complete the structure and without the need for further construction stages.

In particular, the outer portion 24a is translated relative to the basic module 18 and the inner portion 24b is translated relative to the outer portion 24a. The outer portion 24a translates on the guides 34 fitted between the basic module and the outer portion, and the inner portion translates on the further guides 46 fitted between the outer and inner portions.

The projecting portions of the extractable modules, in particular, the inner portion 24a, may have support feet which are put in position when the

maximum extraction of the respective modules has been reached.

An expandable unit such as that shown in Figures 1-3 enables the area and the volume to be enlarged by about 50% of its total value by the extraction of the first extractable module and by about 100% of its total value by the further extraction of the second module.

As can be inferred from the foregoing description, the expandable unit 10 permits easy and quick positioning and installation and, at the same time, an excellent ratio between the initial and final areas (or volumes).

This is achieved by a structure in the form of a container which, in the contracted condition, can retain dimensions that are not only small, but also standardized. The extractable modules are produced in the form of parallelepipeds that are open on one side so as to form a structure which is immediately available for use after the extractable modules have simply been translated relative to the basic module.

A further advantage of the expandable unit according to the invention lies in its unusual structural simplicity which enables it to be

produced at very low cost.

In addition to the examples of use described above, Figures 18-24 show examples of modular use of the expandable unit of the present invention. For this purpose, the basic module, or the extractable module, or both, comprise means for engagement on basic modules or on extractable modules forming part of adjacent expandable units.

In Figure 18, connection takes place between basic modules 18. The side wall 22 is opened to permit connection to an adjacent basic module, for example, with the interposition of an intercommunication element 70. The connection means comprise a bellows-like element 72, the edges of which fit closely against the open edges of the wall 22.

In Figure 20, connection takes place between side walls 26 of the extractable modules 24. In particular, each side wall 26 of the extractable module 24 comprises portions 26a that are articulated so as to be foldable relative to one another in order to open the whole side wall 26 completely and to permit connection to an extractable module of an adjacent expandable unit by means of a bellows element 72.

Clearly, variants and/or additions may be provided for the embodiments described and illustrated.

As an alternative to the arrangement shown in the appended drawings, the extractable module 24 may be formed as a single body and not divided into an inner portion 24a and an outer portion 24b.

According to one possible variant, the roofs of two extractable modules forming part of the same expandable unit may be arranged at different levels to permit further superimposition of the two modules in the contracted configuration. As a result, the abutment elements formed on the corresponding sides of the basic module are disposed at different levels relative to one another in order to be able to interact with the respective abutment elements of the extractable modules when the expandable unit is in the expanded configuration.

In order to satisfy contingent and specific requirements, a person skilled in the art may apply to the above-described preferred embodiment of the expandable unit many modifications, adaptations and replacements of elements with other functionally equivalent elements without, however, departing from the scope of the appended claims.